Cereus uruguayanus (Cactaceae) and its naturalised occurrence in Queensland, Australia

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Summary

Forster, P.I. & Schmeider, M. (2000). *Cereus uruguayanus* (Cactaceae) and its naturalised occurrence in Queensland, Australia. *Austrobaileya* 5(4):671–677. The first records of *Cereus uruguayanus* Ritt. ex Kiesl. as a naturalised weed in Australia are reported. Several populations occur in western Queensland on heavy clay soils in natural and disturbed woodland of brigalow (*Acacia harpophylla* F.Muell. ex Benth.) and belah (*Casuarina cristata* Miq.). Endozoochorial dispersal is thought to be responsible for the spread of this species in natural vegetation and eradication is recommended. It is estimated that at least 3240 individuals occur at one locality near Glenmorgan. Size class structure of this population is described which shows a preponderance of seedling juveniles and large mature plants. The stand is also notable for the high proportion of fasciated (10.9%)and monstrous (20.2%) individuals that occur. This represents the first numerical data on fasciation and monstrousity in a population, albeit naturalised, of Cactaceae.

Keywords: *Cereus uruguayanus,* fasciation, monstrousity, naturalised weeds

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Introduction

Species of Cactaceae have been remarkably successful in colonising the Australian continent with thirty species currently considered as being naturalised (Forster 1996). The majority of naturalised species are from the genus *Opuntia*, although taxa from the genera *Acanthocereus*, *Epiphyllum*, *Harrisia* (syn. *Eriocereus*), *Hylocereus*, *Nyctocereus*, *Pereskia* and *Selenicereus* are also present (Telford 1984; Hosking *et al.* 1988; Forster 1996).

The majority of these naturalised species are shrubby to arborescent, spiny succulents with *Opuntia tomentosa* Salm-Dyck attaining a height of 7 m in some situations. To date, cacti with globular (eg. *Echinopsis* or *Mammillaria*) or candelabra habits (eg. *Cereus* and related genera) have been largely absent from the Australian naturalised cactus flora. Naturalisations of species such as *Echinopsis multiplex* (Pfeiff.) Zucc. have been localised adventives and easily contained (Mann 1970; Hosking *et al.* 1988) and were excluded from recent listings of naturalised cacti (eg. Telford 1984; Forster 1996). In this paper we document an extensive naturalisation of *Cereus uruguayanus* Ritt. ex Kiesl. encountered during a visit in February 1997 to the property "Myall Park" near Glenmorgan. An additional naturalisation has also been found near Tara and another reported from the gemfields at Anakie (J.Higgins pers. comm. 1999).

Cereus uruguayanus is native to Argentina, Brazil and Uruguay but has been widely cultivated around the world since the early 1800's, usually under the name *C. peruvianus* Mill. Kiesling (1982) established that the name *C. peruvianus* was misapplied and renamed the species as *C. uruguayanus* Ritt. ex Kiesl. Hunt (1992) has referred without justification, both the names *C. peruvianus* auct. and *C. uruguayanus* to the synonymy of *C. hildmannianus* and Taylor (1998) has recently recombined *C. uruguayanus* as a subspecies of *C. hildmannianus*. This latter combination was made in a privately published journal series that specialises in automatic tranfers of names with often no justification to support them. In the case of Taylor's new combination there is no explanation offered and until such time as a comprehensive revision of the genus is provided it is more appropriate to follow the nomenclatural lead of Kiesling (1982), a recognised authority on Argentinian cacti.

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In his classic work on the cultivation of cacti, Borg (1937) stated that the species [as *C. peruvianus*] was "Long known in cultivation". Despite its ubiquity in cultivation, there is little ecological or taxonomic information available about this species. Britton & Rose (1920) in their monograph of Cactaceae provide a brief account of both *C. hildmannianus* and *C. peruvianus*, stating that the former occurs in Brazil and the latter in south-eastern South America. Benson (1982) commented that the species (as *C. peruvianus*) was commonly naturalised on Kauai in Hawaii where it was sometimes a pest of pastures. Most contemporary books on cacti omit mention of the species (eg. Barthlott 1979; Andersohn 1983) and accurately identified illustrations are scarce and generally incomplete lacking flowers and fruit (Taylor 1968; Hunter 1988a; Glass & Foster 1989; Innes & Glass 1991; Silva & Sazima 1995). At a locality in south-eastern Brazil, *C. uruguayanus* is stated to occur on rocky outcrops in both forested and deforested areas (Silva & Sazima 1995, as *C. peruvianus*). These authors found that this cactus was predominantly pollinated by hawkmoths and that seasonal flowering coincided with an activity peak for these insects.

Fasciation and monstrosity of the stem is common in naturalised Australian populations of *C. uruguayanus*, hence we also report on its numerical occurrence at one locality. Fasciation in cacti occurs when the apical meristem divides in an abnormal manner forming unusual fan-shaped stems (Synder & Weber 1966; Boke & Ross 1978; Gibson & Nobel 1986) and is thought to be due to several factors, such as external stimuli, disease or heredity (Synder & Weber 1966). Monstrosity in cacti occurs where each shoot loses its vegetative point after producing a few areoles with new growth points produced in an irregular manner. Such fasciated and monstrose clones of cacti are often popular as ornamentals. To the best of our knowledge, there are no detailed studies of fasciation and monstrosity in natural populations of cacti, although the occurrence of isolated individuals in the wild is occasionally reported as a curiosity (eg. Graham 1962; Lindsay 1962; Foster 1965; Synder & Weber 1966; Hunter 1984; Sauleda & Sauleda 1984) and often formally named (eg. Borg 1937; Lindsay 1963; Backeberg 1976). We believe our study to be the first that details the numerical occurrence of fasciation and monstrosity, albeit in a naturalised population.

Materials and Methods

Site Description & History: The study site is situated on the property "Myall Park" (27°12'S, 149° 39'E), near Glenmorgan some 330 km west of Brisbane. "Myall Park" is the site of a private botanic garden "Myall Park Botanic Garden Ltd." that is primarily devoted to Western Australian species and was established in the 1940's by the redoubtable David Gordon (McKenzie 1995). Up until the introduction of the moth *Cactoblastis cactorum* (Berg) in 1933, the area around Glenmorgan was severely infested with 'prickly pear' (*Opuntia stricta* (Haw.) Haw.) and would appear to be suitable for the persistence of different sorts of cacti. Several other species of cacti were believed to have been cultivated at the "Myall Park" homestead by the late 1940's (N.Lester, pers. comm. 1997) and it is assumed that the population of *C. uruguayanus* originates from this time. *C. uruguayanus* was semi-commercially available from nurseries by 1936 (Swinbourne 1982) and by the late 1950's was commonly cultivated in Australia (Fuaux 1957; Hayes 1958 [all as *C. peruvianus*]).

At "Myall Park" individuals of *C. uruguayanus* (Voucher: Forster 20334 & Watson: BRI) are concentrated (27° 12' 16"S, 149° 39' 35"E) in c. 6 ha of disturbed, but reasonably intact woodland dominated by *Casuarina cristata* Miq. (belah) and *Acacia harpophylla* F.Muell. ex Benth. (brigalow) on heavy clay alluvium. Brigalow often occurs as 'clumps' as a result of the formation of 'gilgai', which are depressions in the soil that hold water after heavy rain (Johnson, 1980). The cacti are predominantly concentrated in these clumps of brigalow. Scattered individuals occur outside of this area, nearly always in clumps of natural vegetation, and the furthest individual observed was about 1 km away from the main naturalisation (27°12'40"S, 149°40'14"E). A similar distribution of individuals was also

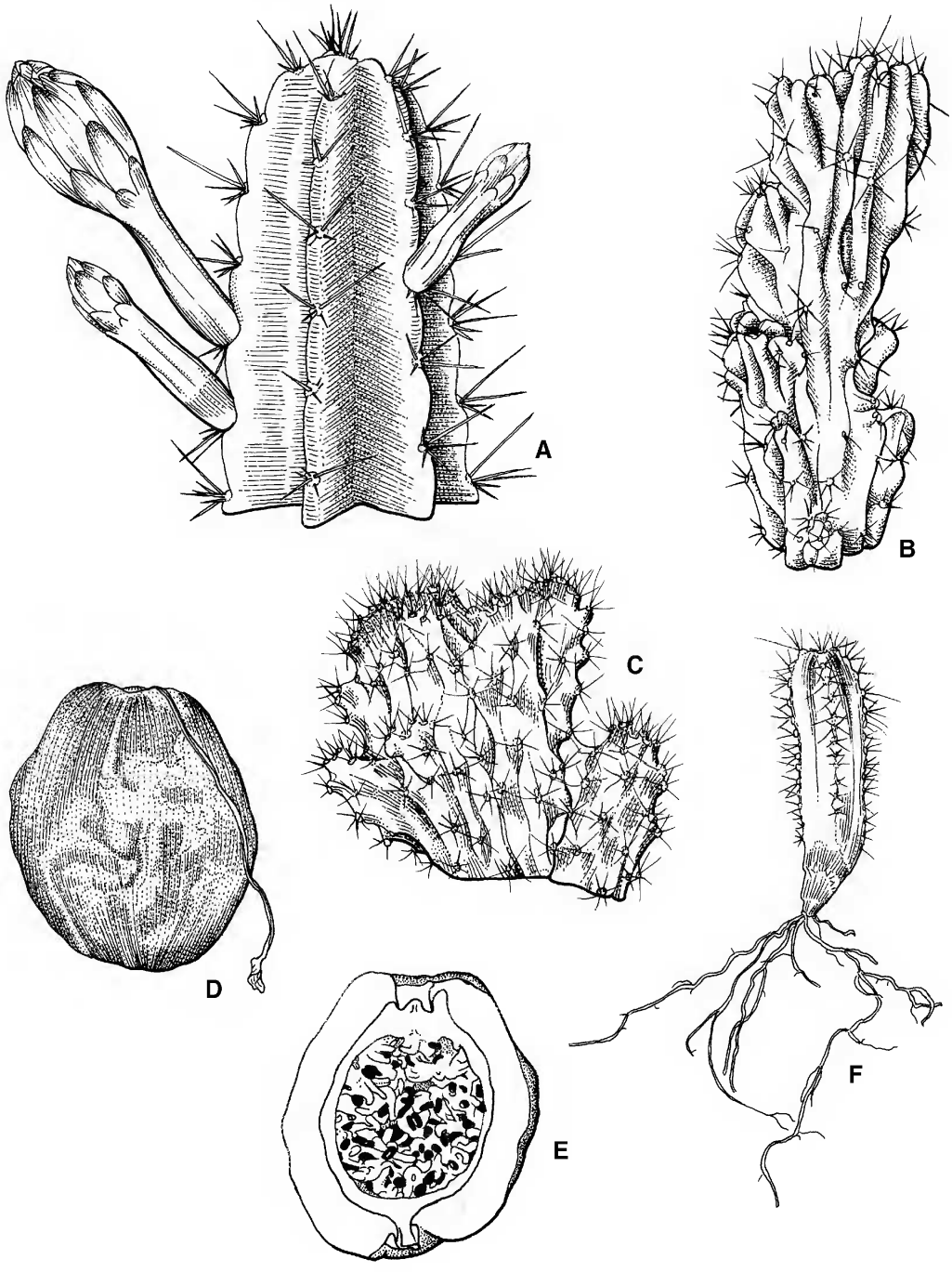

Fig. 1. ***Cereus uruguayanus***. A. budding 'normal' stem. B. 'monstrous' stem. C. 'cristate' stem. D. fruit (whole). E. fruit cross-section. F. seedling. All from Forster 20334 & Watson (BRI). Del. W. Smith.

observed in the population near Tara (Voucher: Forster PIF24959 & Booth, BRI), except that the brigalow community is more disturbed being mainly regrowth.

***Methodology*:** Ten quadrats of 10 × 5 m were placed deliberately within the main concentration of cacti. All individuals of cacti in a quadrat were scored for several features of size class and stem form.

Four size (age) classes of plants were designated -

0-50 cm (classified as juveniles) (Fig. 1E).

50-100 cm (classified as mature as they are capable of flowering and several showed evidence of this).

1-2 m (generally unbranched if with normal stem morphology).

> 2m (generally branched and with a candelabra habit).

Three classes of stem organisation were recognised -

'normal' stems (Fig. 1A) where the 5-7 ribs are not sinuately indented between areoles and are more or less straight.

'monstrous' stems (Fig. 1B) where 7 or more ribs are present with marked indention between areoles and the ribs are rarely straight.

'cristate' stems (Fig. 1C) where it is not possible to accurately ascertain the rib number due to the form of apical cell division where many areoles are densely concentrated and the ribs are never straight.

Spiral stems as illustrated by Hunter (1988a) were not observed nor were cristate flowers as described and illustrated by Müller (1988).

Results: Two hundred and sixty-seven individuals of *C. uruguayanus* were recorded from the 10 quadrats with an average of twenty-seven individuals per plot. Based on this average it is estimated that the total population could be in excess of 3240 individuals. Collectively there was a preponderance of immature seedlings and large (> 1 m) individuals (Fig. 2).

'Normal' individuals make up the bulk of the total population surveyed (68.9%), followed by those with cristate stems (20.2%) and monstrous stems (10.9%) (Fig. 3). 'Cristate' individuals are more frequent in the smaller size classes and for plants over 2 m in height make up only 9.3% of the population (Fig. 2).

Discussion

Natural History

There are few detailed studies available of size class structure in cacti and none for natural populations of *Cereus uruguayanus*. As indicated in the materials and methods, the cacti were noticeably concentrated in natural vegetation of brigalow clumps. In South Africa, Taylor & Walker (1984) found that the closely related *C. jamacaru* DC. [as *C. peruvianus* but see Glen 1997 for correct nomenclature] could only establish on fine-textured soils with a high density of shade trees. The requirement of "prey refugia" and "nurse" plants that create a suitable microclimate for establishment of succulent plants is now well known (Steenbergh & Lowe 1969; Nobel 1988; McAuliffe 1984). The clumped distribution of *C. uruguayanus* at "Myall Park" indicates that a similar process is occurring, but it is likely to be mainly due to "nurse" plant availability rather than "prey refugia". Most of the seedlings observed were not hidden in dense natural vegetation, and predation was noticeably absent on individuals that were otherwise readily accessible. Brigalow clumps may act as a "nurse" plant for *C. uruguayanus* by providing microclimatic conditions suitable for seedling establishment and by acting as foci for seed dispersal.

This cactus is dependent on cross-pollination between different individuals for fruit to be produced (Silva & Sazima 1995). The resultant fleshy fruit with numerous seeds (Fig. 1D) appears suited for endozoochorial dispersal by birds (Bregman 1988). Most of the cacti that are serious pests in Australia are thought to have fruit (and hence seed) that are eaten and dispersed by birds and mammals (Hosking *et al.* 1988). If this is the case for *C. uruguayanus*, it would be worth observing birds that utilise

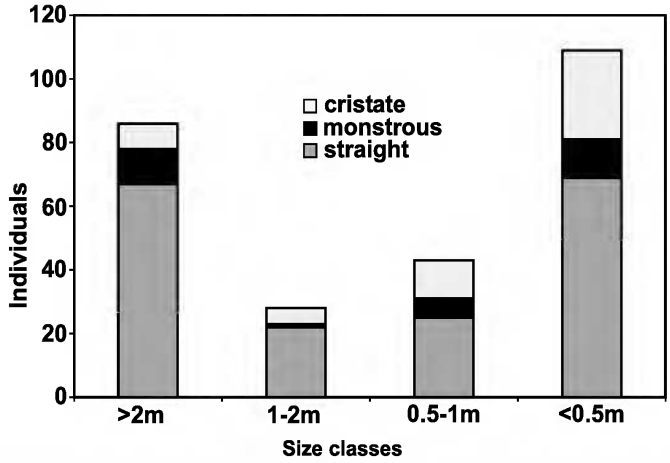

Fig. 2. Total size class distribution for 267 individuals of *C. uruguayanus* in 10 quadrats at "Myall Park". '.

brigalow clumps for roosting to determine those that feed on these fruit and whether they disperse seed over any distance.

As yet this naturalisation is relatively localised, but isolated plants up to a kilometre away would indicate successful endozoochorial dispersal is occurring. The brigalow belt, although widespread in eastern Australia, is now endangered due to clearing for intensive agriculture and cattle grazing and has about 2.2% of its original occurrence conserved in reserves (Young *et al.* 1999). Given the scale of the naturalisation of *C. jamacaru* in South Africa by 1984 (c. 3000 ha), and the success of other cacti as agricultural and environmental weeds in Australia (Hosking *et al.* 1988; Forster 1996), particularly in brigalow communities (McFadyen 1984), it is important that it be successfully controlled.

The size class distribution of individuals at "Myall Park" is different to that found by Taylor & Walker (1984) for *C. jamacaru* as there is a greater preponderance of seedlings and large mature individuals in relation to intermediate sized plants. Such a 'bell' shaped distribution was implied by Taylor & Walker (1984) to indicate unstable populations where stand structure had not yet stabilised and competition between individuals was not restricting seedling establishment. At "Myall Park", seedlings were generally well scattered, although in instances where they were closely situated competition for resources would had to have been a factor. Once established, growth of seedlings of *C. uruguayanus* is rapid and maturity is reached within 3 or 4 years (pers. obs. 1978-1997 on cultivated plants at Didcot). Prior to 1996 the area near Glenmorgan had experienced over 5 years of periodic drought and this may have been responsible for a lack of intermediate sized plants that would have established in that period. The only way to determine these sorts of trends would be to establish permanent plots with tagged individuals; however, in the current situation it would be better if the population was eradicated.

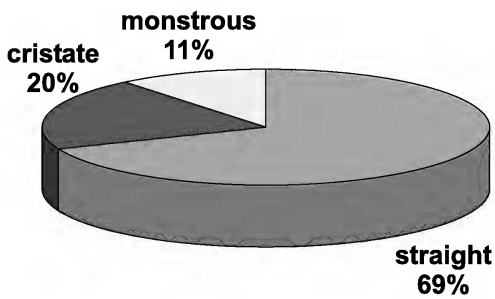

Fig. 3. Total percentage of 'normal', 'cristate' and 'monstrous' individuals of 267 *C. uruguayanus* plants in 10 quadrats at "Myall Park".

Fasciation

Fasciation and monstrosity in *C. uruguayanus* was first documented by de Candolle in 1800 for cultivated material and various infraspecific taxa have been named to encompass these forms (Britton & Rose 1922, Borg 1937; Kiesling 1982). These infraspecific taxa have been mainly described under *C. peruvianus* and none have been transferred to *C. uruguayanus* to date and most discussion of the species still persists under the misapplied name (eg. Hunter 1988a,b; Muller 1988, Machado *et al.* 2000).

This current study demonstrates that fasciation and monstrosity may arise continuously within a population indicating a genetic tendency for this to occur. It has been speculated that somatic cross-overs are a possible mechanism for inducing this variation (Machado *et al.* 2000). Some 'normal' individuals of *C. uruguayanus* were also noted as having the occasional 'monstrous' or 'cristate' branch, hence there is no justification for recognition of such teratological forms as infraspecific taxa as undertaken by Britton & Rose (1922) or Backeberg (1976). Rather, if such forms have to be provided with a name, then selected clones should be designated as cultivars. Given the confused history and doubtful typification of the infraspecific taxa for fasciated individuals described under *C. peruvianus* (Kiesling 1982), it would be wise to arrive at a totally new set of names for such forms of *C. uruguayanus* if so required.

Fasciated individuals of cacti occur rarely in nature (eg. Graham 1962; Lindsay 1962, 1963; Synder & Weber 1966) or cultivation, but seem to be very commonly recorded for *C. uruguayanus* (Kiesling 1982; Hunter 1988a; Müller 1988; Glass & Foster 1989, Machado *et al.* 2000). In the case of the monstrous forms of *Lophocereus schottii* (Englem.) Britt. & Rose described by Lindsay (1963), both were thought to be clones that reproduced vegetatively. Both Graham (1962) and Lindsay (1962) stated or inferred that some populations of cacti tended to have a greater tendency for fasciation than others, but apart from mentioning some localities, did not document numerical occurrence in the wild. This naturalised population of *C. uruguayanus* is probably unusual for the relatively high percentage of such plants but may be a result of the founding individual or individuals carrying genes for this abnormality. Hunter (1988b) stated that seedlings from fruit of the 'monstrose' form of *C. uruguayanus* will be nearly 100% true to form. In the current example, juveniles or small adults of both 'cristate' and 'monstrous' individuals were more common than large mature individuals over 2 m in height.

Acknowledgements

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